COPY

Exhibit A

COPY

Buffer systems maintian a constant pH in blood

The body maintains the pH of blood at around 7.4. If the pH level changes just a few tenths of a pH unit, serious health consequences can result. A decrease in blood ph is called **acidosis**, an increase is called **alkalosis**

Three different buffer systems exist in blood, the bicarbonate buffer and the phosphate buffer are composed of "simple" chemicals. In addition the carbonyl groups (-COOH) and the amide group (-NH2) present on proteins allow some of these to act as buffers. The bicarbonate buffer and the phospate buffer can be described by the following equilibria:

$H_2CO_3 + H_2O \leftrightarrow HCO_3^- + H_3O^+$

$H_2PO_4^- + H_2O \leftrightarrow HPO_4^{2-} + H_3O^+$

- What is the optimal pH for the bicarbonate buffer? [Answer]
- What is the optimal pH for the phosphate buffer? [Answer]
- In each buffer, which species react with added acid? [Answer]
- In each buffer, which species react with added base? [Answer]

The pH for the bicarbonate buffer seems to be outside of its ideal range

Buffer capacity is usually defined as +/- 1 pH unit of the pKa. Notice that the pH of blood is is one unit away from the pKa of carbonic acid. Calculate the ratio of bicarbonate to carbonic acid implied by this. [Answer]

The ratio of bicarbonate to carbonic acid seems to be quite large (and in general this system would not be considered ideal for maintaining a pH of 7.4). However, physiologic conditions make this buffer ideal because:

- excess acid is produced by the body as a byproduct of exercise (lactic acid) making the higher concentration of the conjugate base (bicarbonate) an advantage
- the body has the ability to obtain more carbonic acid by reabsorbing carbon dioxide from the lungs. Recall that carbonic acid is an aqueous solution of carbon dioxide.

In addition, the phosphate buffer as well as the buffering ability of proteins in plasma are also available to maintain blood pH.

Return to Chem 104 home page

Received from < 13106418798 > at 9/23/03 4:25:50 PM [Eastern Daylight Time]